

[0014] To facilitate understanding, identical reference numerals have been used, where possible, to designate identical elements that are common to the figures.

DETAILED DESCRIPTION OF THE INVENTION

[0015] A detailed description related to aspects of the present invention is described hereafter with respect to the accompanying figures.

[0016] FIG. 1 illustrates a schematic perspective view of a portion of a gas turbine engine 100 showing the last stage looking in an aft side with respect to an axial flow direction. The gas turbine engine 100 includes a flow inducer assembly 300 according to embodiments of the present invention. As illustrated in FIG. 1, the gas turbine engine 100 includes a last stage rotor disk 120 and a plurality of last stage turbine blades 140 that are attached along an outer circumference of the rotor disk 120. A plurality of seal plates 200 are attached to the aft side circumference of the last stage rotor disk 120. The seal plate 200 may prevent hot gas coming into the aft side of the rotor disk 120. The seal plates 200 are secured to the rotor disk 120. The rotor disk 120 may rotate in a direction as indicated by the arrow R during operation of the gas turbine engine 100, which rotates the turbine blades 140 and the seal plates 200 therewith in the same direction R. For clarity purpose, one turbine blade 140 and one seal plate 200 are removed from the rotor disk 120.

[0017] With reference to FIG. 1, the rotor disk 120 includes a plurality of disk grooves 122. Each disk groove 122 includes a blade mounting section 124 and a disk cavity 126. Each turbine blade 140 includes a platform 142 and a blade root 144 that extends radially downward from the platform 142. Each turbine blade 140 is attached to the rotor disk 120 by inserting the blade root 144 into the blade mounting section 124 of the rotor disk groove 122. The disk cavity 126 is formed between the blade root 144 and bottom of the disk groove 122. Each seal plate 200 includes an upper seal plate wall 220 and a lower seal plate wall 240. A seal arm 230 may extend axially outward between the upper seal plate wall 220 and the lower seal plate wall 240. The upper seal plate wall 220 covers the blade root 144. A flow inducer assembly 300 is attached to the lower seal plate wall 240. The flow inducer assembly 300 aligns with the disk cavity 126 of the disk groove 122.

[0018] During engine operation, rotation of the last stage turbine blades 140 creates pumping force to drive cooling fluid into the disk cavity 126 of the disk groove 120 as indicated by the cooling flow arrow 130 due to centrifugal force. The cooling fluid enters inside of the turbine blade 140 from the blade root 144 for cooling the turbine blade 140 and exits through openings in the turbine blade 140 to gas path of the gas turbine engine 100. The cooling fluid may be ambient air. According to embodiments of the present invention, the flow inducer assembly 300 arranged on the seal plate 200 provides further driving force to induce ambient air entering the disk cavity 126 for sufficiently cooling the last stage turbine blade 140. The flow inducer assembly 300 and the seal plate 200 may be manufactured as an integrated single piece.

[0019] FIGS. 2 to 7 illustrate schematic perspective views of a seal plate 200 having an integrated flow inducer assembly 300 according to various embodiments of the present invention.

[0020] FIG. 2 illustrates a schematic perspective view of a seal plate 200 having an integrated flow inducer assembly 300 according to an embodiment of the present invention. As shown in FIG. 2, the seal plate 200 includes an upper seal plate wall 220 and a lower seal plate wall 240. A seal arm 230 extends axially outward between the upper seal plate wall 220 and the lower seal plate wall 240. The seal plate 200 may have a hook 202 displaced at a side of the upper seal plate wall 220 facing to the rotor disk 120. The hook 202 may have a U-shape that attaches to the rotor disk 120. The seal plate 200 may have a protrusion 204 protruded from a side of the lower seal plate wall 240 facing to the rotor disk 120. The protrusion 204 may have a dovetail shape that attaches to the rotor disk 120. The hook 202 and the protrusion 204 secure the seal plate 200 to the rotor disk 120. The seal plate 200 has an aperture 242 axially penetrating through the lower seal plate wall 240. The aperture 242 may be located at the lower seal plate wall 240 with a radial distance below the seal arm 230. The aperture 242 may align with the disk cavity 126 of the disk groove 122 after assembly. The aperture 242 may generally have a similar shape with the disk cavity 126.

[0021] According to an exemplary embodiment as illustrated in FIG. 2, a flow inducer assembly 300 is integrated to the seal plate 200 at a side facing away from the rotor disk 120 extending outward in an axial direction. The flow inducer assembly 300 may include a curved plate 310 attached radially along the aperture 242 at a downstream side with respect to the rotation direction R of the rotor disk 120 as shown in FIG. 1. The curved plate 310 may be blended with the aperture 242 in a tangential direction of the aperture 242. The curved plate 310 may have a similar curvature with the aperture 242. During operation of the gas turbine engine 100, rotation of the rotor disk 120 and the seal plate 200 therewith makes the curved plate 310 of the flow inducer assembly 300 functioned as a paddle that further induces cooling air 130, such as ambient air from outside of the gas turbine engine 100, in addition to centrifugal force caused by rotation of the turbine blades 140, into the aperture 242 and the disk cavity 126 and enters insides of the turbine blades 140 from the blade roots 144 for cooling the turbine blades 140. The curved plate 310 may have a scoop shape.

[0022] Dimensions of the flow inducer assembly 300 may be designed to achieve cooling requirement for sufficiently cooling the turbine blades 140. Dimensions of the flow inducer assembly may include a radial height of the curved plate 310, an axial length of the curved plate 310, etc. A radial height of the curved plate 310 may be less than, or equal to, or greater than a radial height of the aperture 242. For illustration purpose, FIG. 2 and FIG. 3 show the curved plates 310 having different radial heights. According to an exemplary embodiment as illustrated in FIG. 2, a radial height of the curved plate 310 is equal to a radial height of the aperture 242. As illustrated in FIG. 2, the curved plate 310 is attached along the aperture 242 at the downstream side starting from the lowest point of the aperture 242 and ending at the highest point of the aperture 242.

[0023] According to another exemplary embodiment as illustrated in FIG. 3, a radial height of the curved plate 310 is greater than a radial height of the aperture 242. As illustrated in FIG. 3, the curved plate 310 is attached along the aperture 242 at the downstream side starting from the lowest point of the aperture 242 and ending at the seal arm